Dr.SNS RAJALAKSHMI COLLEGE OF ARTS AND SCIENCE (Autonomous)

Accredited by NAAC – UGC with 'A+ Grade (Cycle IV)

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Coimbatore- 49

DEPARTMENT OF MATHEMATICS

21UCR304: BUSINESS CALCULUS AND FINANCIAL COMPUTATION

DIFFERENTIATION

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What is Differentiation?

Differentiation is the process of finding the **derivative** of a function,

which measures the **instantaneous rate of change** or the **slope of the curve** at any point.

Example meaning:

If $y = f(x)$, then the derivative $f'(x)$ tells how fast y changes with respect to x.

Derivative Definition

The derivative of $f(x)$ at x is defined as:

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

This represents the slope of the **tangent line** at the point.

Basic Derivative Rules

- $\frac{d}{dx}(c) = 0$
- $\frac{d}{dx}(x^n) = nx^{n-1}$
- $\frac{d}{dx}(e^x) = e^x$
- $\frac{d}{dx}(\ln x) = \frac{1}{x}$
- Sum Rule: $(f + g)' = f' + g'$

Problem

Find the derivative of:

$$f(x) = (3x^4 - 5x + 2)(2x^2 + 1)$$

Solution (Using Product Rule):

$$f'(x) = (12x^3 - 5)(2x^2 + 1) + (3x^4 - 5x + 2)(4x)$$

Expanded form:

$$= 24x^5 + 12x^3 - 10x^2 - 5 + 12x^5 - 20x^2 + 8x$$

Final answer:

$$\boxed{36x^5 + 12x^3 - 30x^2 + 8x - 5}$$

Problem

Differentiate:

$$f(x) = \frac{5x^3 - 2x + 1}{x^2}$$

Solution (Quotient Rule OR simplify):

Simplify first:

$$f(x) = 5x - 2 + x^{-2}$$

Differentiate:

$$f'(x) = 5 + 0 - 2x^{-3}$$

Final answer:

$$\boxed{5 - \frac{2}{x^3}}$$

THANK YOU